

Answer **all** questions.

1 (a) Fig. 1.1 is a diagram of a human chromosome at a stage in mitosis.

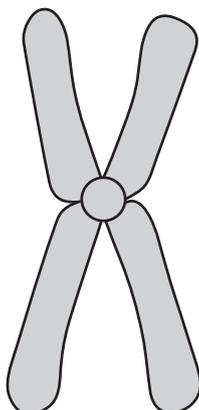


Fig. 1.1

(i) The paragraph describes the structure of the chromosome shown in Fig. 1.1.

Complete the paragraph using the most appropriate term in each space provided.

The chromosome shown in Fig. 1.1 has two genetically identical
 joined at a The
 chromosome is composed of two DNA molecules, each wrapped around proteins known
 as proteins.

[3]

(ii) State **one** stage during mitosis when the chromosome would appear as shown in Fig. 1.1.

..... [1]

(iii) Suggest the role of ATP in the process of mitosis.

.....

 [2]

(b) Prokaryotes divide by a process known as binary fission.

Fig. 1.2 shows some of the stages in binary fission.

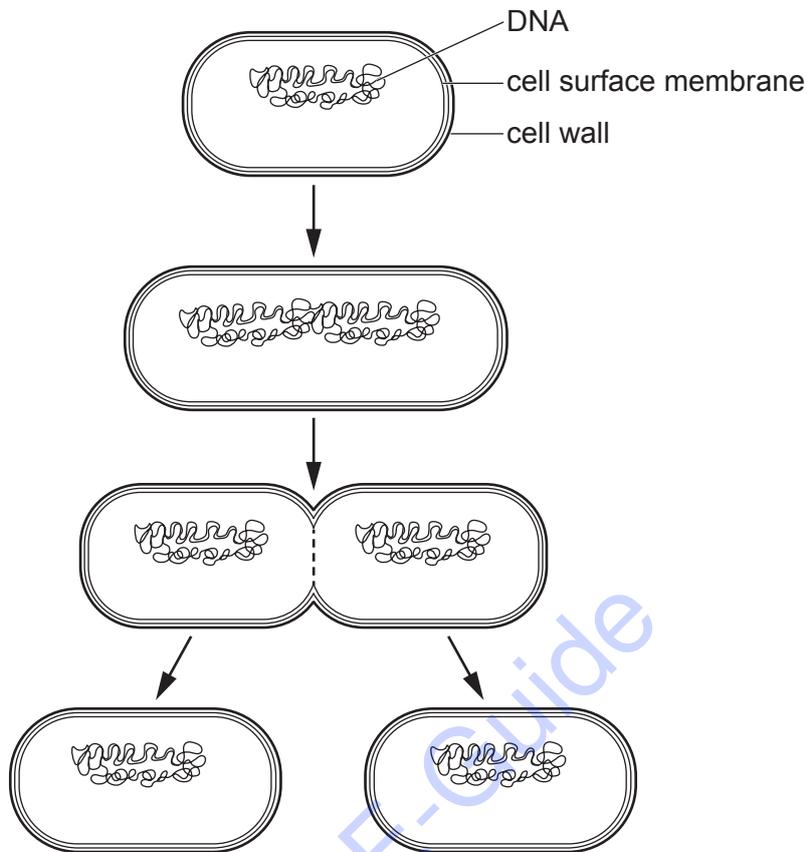


Fig. 1.2

With reference to Fig. 1.2, identify **two** events that occur during binary fission that do **not** occur during mitosis in human cells.

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.....

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..... [2]

[Total: 8]

2 (a) Fig. 2.1 shows the molecular structure of a triglyceride molecule.

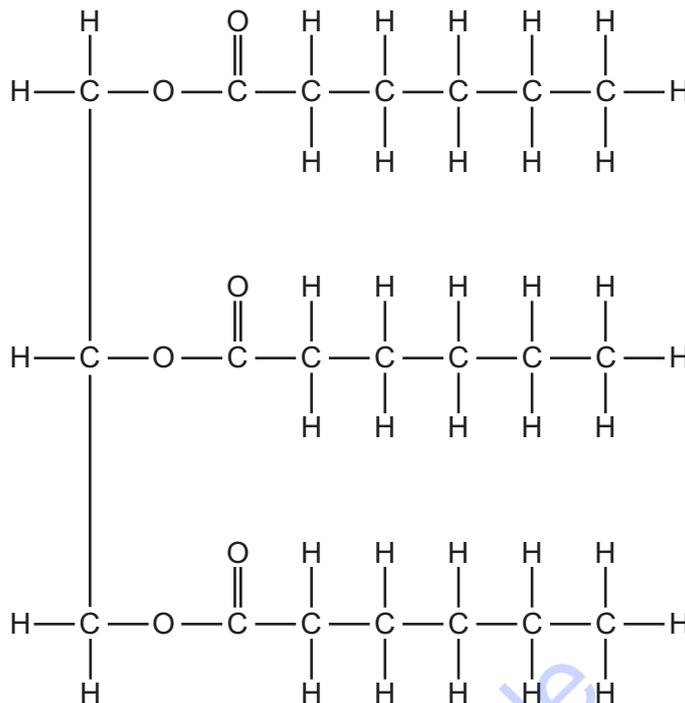


Fig. 2.1

(i) Draw a circle around an ester bond shown in Fig. 2.1. [1]

(ii) Name the type of reaction used to produce a triglyceride from its components.

State the number of water molecules produced during this reaction.

type of reaction

number of water molecules produced

[2]

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(b) Lipases are enzymes that digest triglycerides in the lumen of the human intestine. These enzymes are released by exocytosis from intestinal epithelial cells.

(i) Underline **all** the terms from the list that are used to describe these lipases.

macromolecule

extracellular enzyme

fibrous protein

polysaccharide

[1]

Scientists have found that treating milk with lipase can improve its taste.

The scientists carried out an experiment to determine the effect of lipase activity on the triglycerides found in milk.

- Lipase was immobilised in alginate beads.
- The pH of a known volume of milk was adjusted to pH8 by adding an alkali.
- The beads were then mixed with this milk in a beaker.
- The pH of the reaction mixture was recorded over a period of 24 hours.

The results are shown in Fig. 2.2.

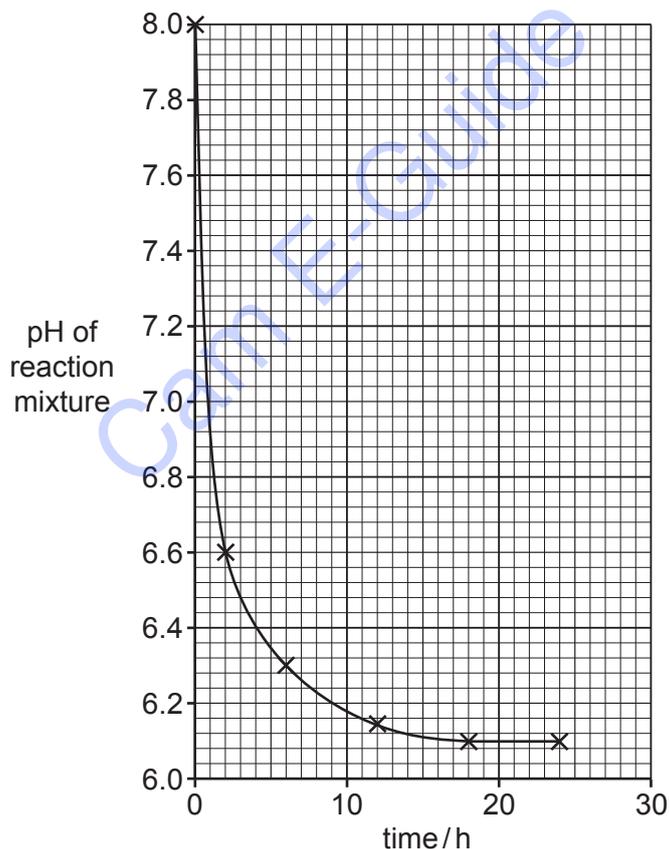


Fig. 2.2

3 (a) The circulatory system of mammals is a double circulation.

(i) Explain what is meant by the term double circulation.

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.....
..... [1]

(ii) Fig. 3.1 is a photograph showing one valve in the mammalian heart.

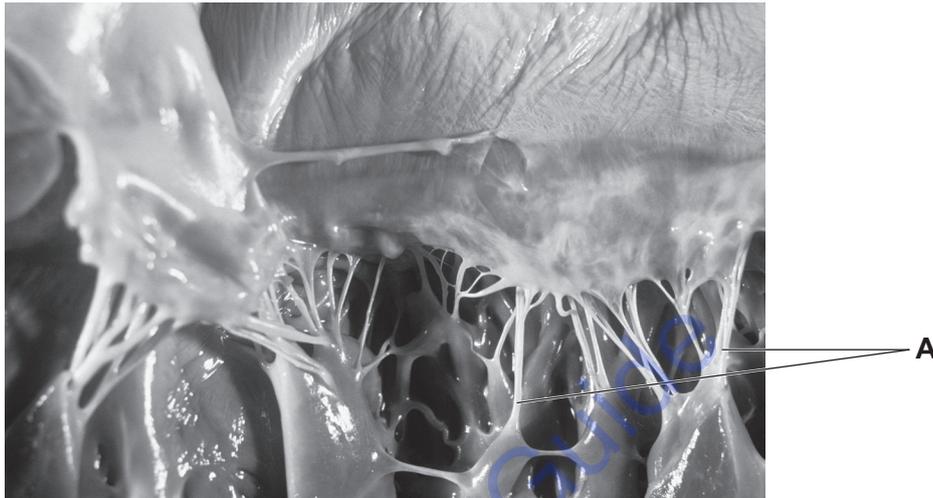


Fig. 3.1

Identify the structures labelled **A** in Fig. 3.1 and describe their role during the cardiac cycle.

structure **A**

role of structure **A**

.....
.....
.....
.....
.....
.....
.....

[3]

- (b) The endocardium is a thin layer of tissue lining the chambers of the heart. A serious condition called endocarditis results if bacteria infect this tissue.

Endocarditis is treated with a combination of antibiotics. This increases the effectiveness of the treatment and reduces the risk of antibiotic resistance in bacteria.

Table 3.1 shows the action of two antibiotics used together to treat endocarditis.

Table 3.1

antibiotic used in treatment	action of antibiotic
gentamicin	binds permanently to the bacterial ribosomes
penicillin G	inhibits an enzyme involved in cell wall synthesis

- (i) With reference to Table 3.1, explain why treating endocarditis with a combination of gentamicin and penicillin G reduces the risk of developing antibiotic resistance.

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..... [2]

- (ii) Describe how the bacteria that cause endocarditis could become resistant to gentamicin.

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..... [3]

[Total: 9]

4 (a) Fig. 4.1 is a scanning electron micrograph of a section of a plant cell wall.

In living plant tissue cytoplasmic strands form part of structure **W**.

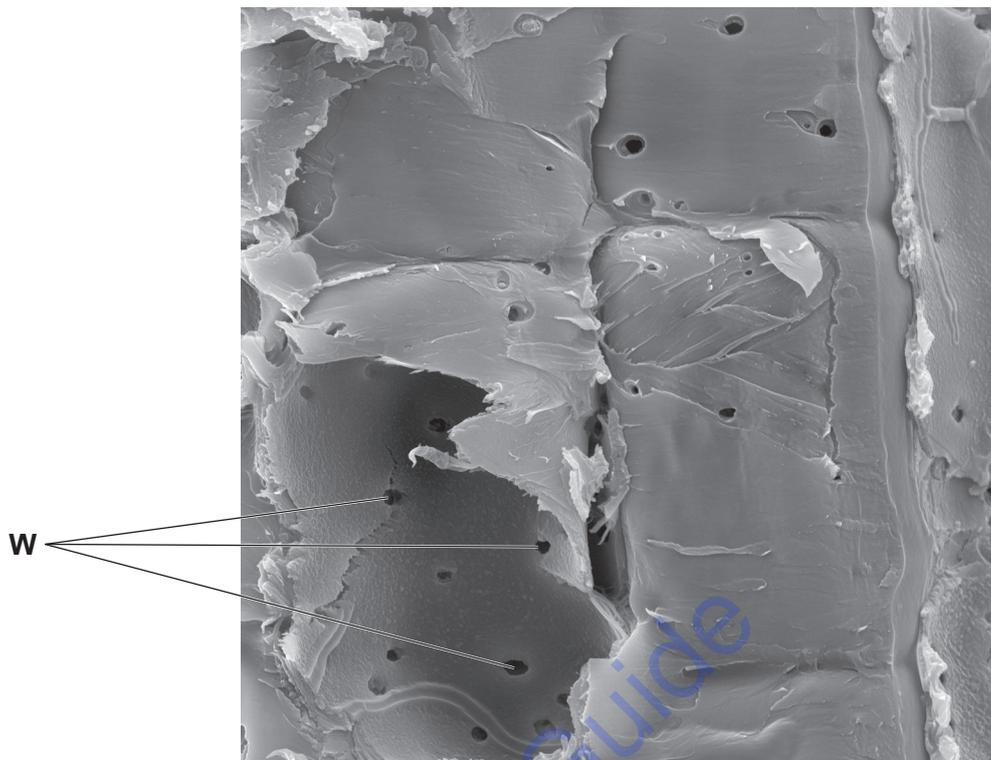


Fig. 4.1

(i) Identify the structures labelled **W** in Fig. 4.1.

..... [1]

(ii) Describe the function of structure **W**.

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..... [2]

(b) Viruses can infect plant cells.

(i) Outline the key structural features of a virus.

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..... [2]

- 5 (a) Fig. 5.1 is a photomicrograph of a section through the lungs showing a bronchus and some alveoli.

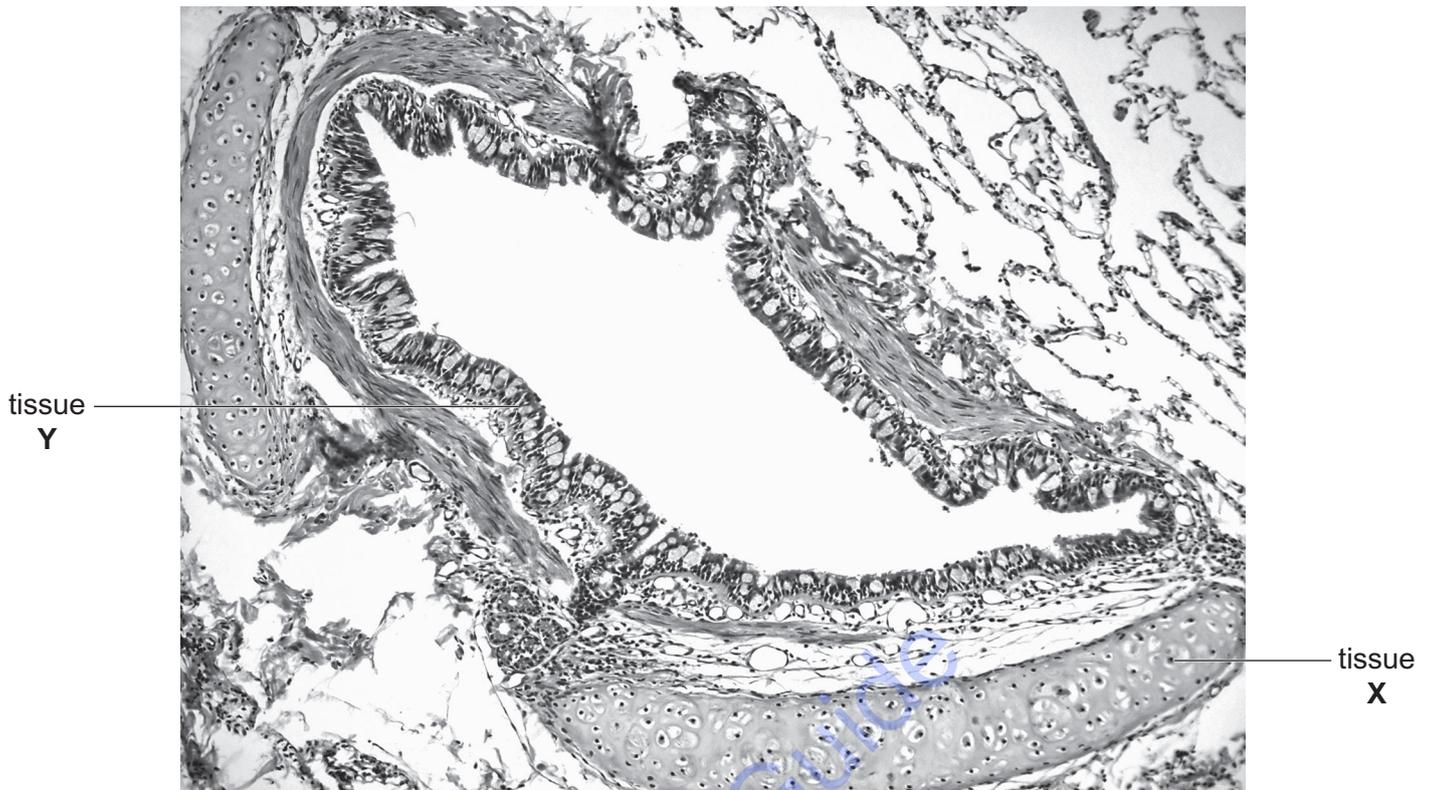


Fig. 5.1

- (i) State the function of tissue X labelled in Fig. 5.1.

.....
..... [1]

- (ii) Describe how the distribution of tissue X in the trachea differs from that shown in Fig. 5.1.

.....
..... [1]

- (iii) Describe how the epithelial tissue, Y, is adapted for its function.

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.....
..... [2]

(b) Fig. 5.2 is a photograph of two African elephants, *Loxodonta africana*.



Fig. 5.2

(i) Describe the difference in surface area to volume ratio between the adult elephant and baby elephant shown in Fig. 5.2.

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..... [1]

(ii) Suggest why animals such as elephants require a gas exchange system.

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..... [3]

6 (a) Mutations in body cells can sometimes result in a tumour. Some tumours are cancerous.

(i) Outline how mutations can result in the development of a tumour.

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..... [2]

(ii) Tumour cells have antigens on their cell surface that are not present on non-tumour cells.

These antigens are the result of gene mutations and are known as tumour specific antigens (TSA).

One type of TSA differs in structure from the protein found on the cell surface of non-tumour cells by a single amino acid.

Explain how a gene mutation could result in the production of this TSA.

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..... [2]

Question 6 continues on page 16

- (b) Immunotherapy is a form of treatment for cancer which aims to stimulate the immune system to destroy tumour cells.

One form of immunotherapy for cancer uses a vaccine which contains one specific type of TSA.

- (i) Describe how vaccination with a specific type of TSA could lead to the destruction of tumour cells by T-lymphocytes in the body.

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..... [3]

- (ii) Vaccines that contain tumour cells instead of a TSA are being developed for use during immunotherapy. Tumour cells are removed from a patient’s body and used in a vaccine for the patient.

Suggest **one** advantage and **one** disadvantage of using a patient’s tumour cells in a vaccine rather than a TSA.

advantage

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disadvantage

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..... [2]

[Total: 9]

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